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EXAMINER	
COOLEY, CHARLES E	
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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	10/642,793	OPFER, MARK H.
	Examiner	Art Unit
	Charles E. Cooley	1723

-- *The MAILING DATE of this communication appears on the cover sheet with the correspondence address* --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-16* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-16* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *18 August 2003* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☒ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *10202003*.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

NON-FINAL OFFICE ACTION

1. This application has been assigned to Technology Center 1700, Art Unit 1723 and the following will apply for this application:

Please direct all written correspondence with the correct application serial number for this application to Art Unit 1723.

Telephone inquiries regarding this application should be directed to the Electronic Business Center (EBC) at http://www.uspto.gov/ebc/index.html or 1-866-217-9197 or to the Examiner at (571) 272-1139. All official facsimiles should be transmitted to (703) 872-9306.

2. As the PTO continues to move towards a fully electronic environment, the office will phase-in its E-Patent Reference program. This program: (1) provides downloading capability of the U.S. patents and U.S. patent application publications cited in Office actions via the E-Patent Reference feature of the Office's PAIR system; and (2) ceases mailing paper copies of U.S. patents and U.S. patent application publications with office actions except for citations made during the international stage of an international application under PCT.

Effective June 2004, paper copies of cited U.S. patents and U.S. patent application publications will cease to be mailed to applicants with Office actions from this Technology Center. Paper copies of foreign patents and non-patent literature will continue to be included with office actions.

The U.S. patents and patent application publications cited in office actions are available for download via the Office's PAIR system. As an alternate source, all U.S.

patents and patent application publications are available on the USPTO web site (www.uspto.gov), from the Office of Public Records and from commercial sources. Inquiries about the use of the Office's PAIR system should be referred to the Electronic Business Center (EBC) at http://www.uspto.gov/ebc/index.html or 1-866-217-9197.

Requests to restart a period for response due to a missing U.S. patent or patent application publications will not be granted.

Information Disclosure Statement

3. Note the attached PTO-1449 form submitted with the Information Disclosure Statement filed 20 OCT 2003.

Drawings

4. The drawings are objected to because of the following informalities:

   a. the drawing figures do not comply with 37 CFR 1.84 (see the attached PTO-948 form).

   Replacement sheets are required as explained below.

5. Applicant should verify that (1) all reference characters in the drawings are described in the detailed description portion of the specification and (2) all reference characters mentioned in the specification are included in the appropriate drawing Figure(s) as required by 37 CFR 1.84(p)(5).

INFORMATION ON HOW TO EFFECT DRAWING CHANGES

Replacement Drawing Sheets

Drawing changes must be made by presenting replacement figures which incorporate the desired changes and which comply with 37 CFR 1.84. An explanation of the changes made must be presented either in the drawing amendments, or remarks, section of the amendment. Any replacement drawing sheet must be identified in the top margin as "Replacement Sheet" (37 CFR 1.121(d)) and include all of the figures appearing on the immediate prior version of the sheet, even though only one figure may be amended. The figure or figure number of the amended drawing(s) must not be labeled as "amended." If the changes to the drawing figure(s) are not accepted by the examiner, applicant will be notified of any required corrective action in the next Office action. No further drawing submission will be required, unless applicant is notified.

Identifying indicia, if provided, should include the title of the invention, inventor's name, and application number, or docket number (if any) if an application number has not been assigned to the application. If this information is provided, it must be placed on the front of each sheet and centered within the top margin.

Annotated Drawing Sheets

A marked-up copy of any amended drawing figure, including annotations indicating the changes made, may be submitted or required by the examiner. The annotated drawing sheets must be clearly labeled as "Annotated Marked-up Drawings" and accompany the replacement sheets.

Timing of Corrections

Applicant is required to submit acceptable corrected drawings within the time period set in the Office action. See 37 CFR 1.85(a). Failure to take corrective action within the set period will result in ABANDONMENT of the application.

If corrected drawings are required in a Notice of Allowability (PTOL-37), the new drawings MUST be filed within the THREE MONTH shortened statutory period set for reply in the "Notice of Allowability." Extensions of time may NOT be obtained under the provisions of 37 CFR 1.136 for filing the corrected drawings after the mailing of a Notice of Allowability.

Specification

6. The specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

7. The abstract is acceptable.

8. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed (MPEP 606.01).

Claim Rejections - 35 USC § 102

9. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

10. Claims 1, 3, 5, 6, 7, 8, and 11-16 are rejected under 35 U.S.C. 102(b) as being anticipated by Berger et al. (US 5,879,279).

The patent to Berger et al. '279 discloses a centrifuge apparatus and method of separating particulate from fluids whereby in Fig. 1 a high speed centrifugal

separator 10 is shown positioned on a stand 11 and disposed in fluid communication with a reservoir/tank 13. The centrifugal separator 10 is coupled and in data communication with a controller 12. The reservoir/tank 13 is designed and constructed to hold a composition comprising fluids and solids. The composition of fluid comprises a liquid and solid. The composition is pumped from the reservoir/tank 13 into the centrifugal separator 10 for subjection to high-speed centrifugal gravitational separation in a bowl. The composition is separated into a fluid portion and a solid portion. The bowl may rotate during the separation mode in a speed range of about 3,000-4,000 revolutions per minute or rotates in a speed range of about 2,000-3,000 revolutions per minute. The separation mode is a portion of the run cycle of the separator during which the bowl is revolved at substantially high speeds so that centrifugal forces can act on the material within the bowl to separate the solids and liquids. The centrifugal separator 10 includes a substantially rigid structural frame 14 for supporting components associated with the separator 10. Frame 14 is a fabricated metal structure. A fluid collection system 15 is positioned within frame 14 for receiving the substantially pure fluid exiting the discharge 16. The fluid discharge 16 being located along the top 150 of the bowl 42, and in the preferred embodiment defining a substantially annular discharge opening. The fluid collection system 15 includes an inclined drain trough 16 that allows the fluid to flow by gravity to a centralized collection point 17. An integrally formed main bearing housing 18 having a radially outward extending portion 19 which is coupled to the frame 14. The main bearing housing 18 is formed of cast steel and is substantially symmetric about a vertical centerline Y. A first bearing seat 22 is formed on a first end

20 of housing 18, and a second bearing seat 23 is formed on a second end 21 of housing 18. A first bearing 24 and a second bearing 25 are positioned within the first bearing seat 22 and the second bearing seat 23 respectively. Preferably bearings 24 and 25 are rolling element type bearings, and it is more preferred that bearings 24 and 25 be ball type bearing. The bearings 24 and 25 each have an outer bearing race that is fixedly coupled to the main bearing housing 18. A main drive spindle 30 extending along the vertical centerline Y is positioned within and rotatable relative to the main bearing housing 18. Main drive spindle 30 is a substantially rigid shaft having a first bearing seat 31 and a second bearing seat 32 formed therein. The bearing seats 31 and 32 are sized and located so as to be received within the inner bearing races of bearing 24 and 25. The bearings 24 and 25 are coupled between the main drive spindle 30 and housing 18 to allow the main drive spindle 30 to efficiently rotate within the housing 18. A bearing keeper 33 is utilized to hold bearing 24 in place. Further, the main drive spindle 30 is coupled to a drive mechanism for revolving the main drive spindle 30 about the centerline Y. The main drive spindle 30 being revolved by the drive mechanism at a high speed during a high-speed separation mode to substantially separate the liquid and particles. The drive mechanism includes an electric motor 36. The main drive spindle 30 includes an enlarged end 37 having a bearing seat 38 formed therein. The enlarged end 37 includes a substantially planar annular ring 90 sized to receive a plurality of clutch pad member coupling pins 39 therein. Main drive spindle 30 has an extended portion 40 that projects from the main bearing housing 18 and is sized to fit within a central aperture 41 of the centrifugal bowl 42. A lock ring 43 is

coupled to the extended portion 40 to hold the bowl 42 and main drive spindle 30 together. The main drive spindle 30 and bowl 42 being locked together so there is no substantial relative motion therebetween. Further, in a preferred form of the present invention the bowl 42 being oriented such that it is rotatable around the vertical centerline Y. A fluid conduit 45 is coupled to the main bearing housing 18 and is in fluid communication with an aperture 46 extending into the main bearing housing 18. The main bearing housing has an internal cavity 47. The fluid conduit 45 receives a fluid flow of pressurized fluid for delivery to the internal cavity 47 of the main bearing housing 18. A fluid discharge orifice 48 is formed through an outer wall of the bearing housing 18 and allows the discharge of fluid from within the internal cavity 47. A passageway 94 is formed in the main bearing housing 18 adjacent the lower main bearing 25 for the passage of fluid between the internal cavity 47 and a related cavity 151. The passageway 94 extends axially adjacent the outer race of bearing 25, (parallel to centerline Y) in the bearing housing 18. The passage of fluids between the internal cavity 47 and related cavity 48 prevents any substantial pressure differential across the bearing 25, thereby eliminating the drawing of lubricant out of the bearing 25. Further, the passage of fluid within the internal cavity acts to help cool the bearings 24 and 25 and prevent them from overheating. A labyrinth seal 50 is positioned between the main bearing housing 18 and a rim 42a of the bowl. The labyrinth seal 50 forms a sliding substantially fluid tight annular seal between the bowl 30 and the main bearing housing 18 to block the flow of contaminants to the main bearing housing. In Fig. 3a, a labyrinth seal 50 having a ring 18g extending into a circular groove 42b formed in bowl 42. The

ring 18g is formed in the bearing housing 18 and extending parallel to centerline Y. A substantially rigid plow blade or scraper drive shaft 55 extends through an aperture 56 formed through the main drive spindle 30. Plow blade drive shaft 55 is coupled to a rolling element type bearing 57 that is positioned within the bearing seat 38. The bearing 57 is a ball type bearing. A plow blade bushing 58 is fixedly attached to the wall of the main drive spindle 30 at the opposite other end of the aperture 56 and the shaft 55 is rotatably positioned within the bushing 58. The plow blade drive shaft 55 is rotatable on bearing 57 and bushing 58 within the aperture 56 formed in main drive spindle 30. The plow blade drive shaft 55 extends from the main bearing housing 18 to allow clearance between the bottom 18a of the housing 18 and a plow blade assembly 60. A labyrinth seal 125 is coupled between the main drive spindle 30 and the plow blade drive shaft 55 to protect the lower main bearing 25 and bushing 58 by minimizing the passage of contaminants therebetween. Labyrinth seal 125 is similar to labyrinth seal 50 in that it has a ring 125a extending into a groove 125b. The plow blade or scraper assembly 60 includes a plurality of plow blades 60a coupled to the plow blade drive shaft 55 at a central hub 61. The edge of the plow blades 60a are spaced a distance from the bowl 42, and may be spaced 0.050 inches from the bowl. The plurality of plow blades 60 form a substantially rigid erosion resistant member that is rotatable within the bowl 42 during a cleaning mode to dislodge solids deposited on the bowl. The solid particles are received and accumulated on the bowl wall member during the separation mode. The plow blade assembly 60 may have four plow blades 60a fixedly spaced about 90 degrees apart. The bowl 42 has a solid discharge opening

152 located at its bottom end 42c that allows the dislodged solids to pass through a chute 120 into a material collection hopper. The chute 120 is located beneath the bowl 42 and substantially aligned with the centerline Y. Chute 120 having a mechanically actuated lid 118 that closes and uncloses access to the hopper. A first bevel gear 65 is fixedly connected to the enlarged end 37 of the main drive spindle 30, and a second bevel gear 95 is coupled to the plow blade drive shaft 55. A drive 96 having a pinion gear 97 coupled thereto is moveable to engage the bevel gears 95 and 65 to drive the plow blade drive shaft 55 and main drive spindle 30 in counter-rotating directions. The drive 96 includes an electric motor 100 and drive assembly 101. A pneumatic cylinder 102 is utilized to move the pinion gear 97 into and out of engagement with the bevel gears 95 and 65. In Figs. 4a and 4b there is illustrated a substantially cylindrical hub 99 coupled to the plow blade drive shaft 55. The substantially cylindrical hub 99 having a cylindrical inner wall member 99a that is engagable by a plurality of clutch pad members 160 as the main drive rotates the main drive spindle 30. The plurality of centrifugal clutch pad members 160 are rotatably mounted by the clutch pad coupling pins 39 to the planar annular ring 90 formed on the enlarged end 37 of the main drive spindle 30. The plurality of clutch pad members 160 are connected to a clutch pad carrier 161. Clutch pad members 160 having a surface coefficient of friction greater than the surface coefficient of friction for the clutch pad engaging surface 99a. Upon the main drive spindle 30 being rotated the clutch pad members 160 are thrown radially outward by centrifugal gravitational forces such that they engage the clutch pad engaging surface 99a of the hub 99. Clutch pad members 160 have a clutch face that is placed in contact

with the clutch pad-engaging surface of wall member 99a to mechanically couple the bowl 30 and plow blade drive shaft 55 together. The centrifugal clutch described above couples the main drive spindle 30 and the plow blade drive shaft 55 together and prevents the relative movement between the plow blade assembly 60 and the bowl 42 during the separation mode. The separation mode is generally known to those of ordinary skill in the art as the period in which the bowl is rotated at a relatively high speed to force the particles within the liquid and solid composition to be separated from each other. A fluid delivery tube 170 passes into the centrifugal separator 10 to allow the delivery of contaminated fluid to be processed by the separator, the fluid passing through a central aperture 171 within the plow blade drive shaft 55 to the centrifugal bowl 42. The fluid exits the passageway in the drive shaft 55 via a plurality of apertures 55c formed in an impeller disk 55b coupled to the plow blade drive shaft 55 and into the bowl for separation. A directing member 191 is positioned within bowl 42 for directing the movement of the fluid composition within the bowl radially outward toward the outer wall. In the preferred embodiment the directing member 191 is a substantially annular ring that is coupled to the top/rim end of the bowl 42. The ring extending radially outward from the inner wall of the bowl, so as to prevent the discharge of fluid proximate the inner wall of the bowl. The directing member forcing the fluid composition to be moved radially outward so that the solid particles are subjected to greater centrifugal forces.

The operation of the centrifuge 10 includes processing the contaminated fluid in a processing cycle that includes running in a high-speed separation mode, stopping the

separation mode, and then operating a cleaning/bowl solid particle-dislodging mode. The bowl 42 may be run until full of solids to increase the efficiently of the operation. The bowl is brought to a stop and the plow blade or scraper assembly 60 is actuated to dislodge the accumulated solids from the bowl wall. A vibration/load sensor 180 controls the operation of the centrifugal separator 10 during the high-speed separation mode. In one embodiment the vibration sensor 180 being spaced radially outward from the main drive spindle 30. In the preferred embodiment the vibration sensor 180 is a dual output vibration sensor that is mounted to frame 14, and spaced radially outward from the bowl 42. The vibration sensor 180 is in data communication with controller 12 via a data communication pathway. The controller 12 receives the respective signals from the vibration sensor 180 to control the rotation of bowl 42 and the rotation of cleaning blade assembly 60. Upon receiving a signal from the sensor 180 that indicates that a threshold parameter has been exceeded a D.C. Brake or Frequency Inverter is actuated to stop the rotation of bowl 42, and to commence the clean mode wherein the plow blade drive shaft 55 with blade assembly 60 is rotated to dislodge accumulated material within the bowl. The vibration sensor 180 is located proximate the bowl 42 for sensing the radial vibration associated with the high speed rotation of the bowl 42. The vibration sensor 180 having: a first predetermined threshold and upon sensing radial vibration of the bowl above the first predetermined threshold a first signal is sent to stop the rotation of the bowl 42; and a second predetermined threshold and upon sensing radial vibration of the bowl above the second predetermined threshold a second signal is sent to stop the rotation of the bowl 42. Each of the first predetermined

threshold and second predetermined threshold having a magnitude component and a time duration component. The first predetermined threshold having first magnitude component and a first time duration component and the second predetermined threshold having a second magnitude component and a second time duration component. In the preferred embodiment the first magnitude component is greater than the second magnitude component and the first time duration component is less than the second time duration component. The first predetermined threshold is designed to trigger a signal during an emergency or bowl dynamic imbalance condition, and the second predetermined threshold being designed to trigger a signal during a full bowl condition. The first predetermined threshold being set such that radial vibration amplitude above 1.5 inches/per second would exceed the first magnitude component. Further, the time duration component of the first predetermined threshold being in the range of about two to fifteen seconds. In order for the first predetermined threshold to be exceeded both the first magnitude component and first time duration component must be satisfied. In a more preferred embodiment of the present invention the first time duration component is in the range of about two-four seconds, and the first magnitude component is about 0.5 inches/per second. Since the second predetermined threshold is more closely related to the evenly filled full bowl state a lower magnitude component and longer time duration component are its constituent parts. The second predetermined threshold having a second magnitude component less than about 0.75 inches per second and a second time duration component in the range of about thirty-sixty seconds. The maximum time the separation mode is allowed to run is also time

limited, so as to further safeguard the bowl 42 from becoming overfilled with solids separated from the contaminated fluid. The time is limited by a timer device. An overcurrent sensor is utilized to protect the plow blade drive shaft motor. The overcurrent sensor is designed to prevent damage to the plow blade drive shaft motor in situations where the torque required to dislodge the particles adhering to the bowl is greater than the capacity of the plow motor. The overcurrent sensor is set to trip just above the full load amp rating of the plow motor. Upon the tripping of the overcurrent sensor a signal is sent to the controller to shut the plow motor down. After, a time delay the plow blade drive motor is restarted to rotate the plow blade drive shaft 55 and scrape blade assembly 60 in the opposite direction. The changing of direction will continue each time that the overcurrent sensor is tripped. When there has been a prolonged period of rotation in either direction with no tripping of the overcurrent sensor the control of the cleaning mode is done by the controller 12. More specifically, controller 12 controls the duration of rotation in a first clockwise direction, a second counter-clockwise direction, a time delay between switching directions of rotation, and an overall rotation time. Upon completion of the overall rotation time the pinion gear 37 is disengaged to stop the rotation of the plow motor drive shaft.

11. Claims 1, 5, 6, and 7 are rejected under 35 U.S.C. 102(e) as being anticipated by Beattey (US 6,478,724).

The patent to Beattey '724 discloses in FIGS. 1 and 2, a centrifugal separator with a frictional mechanism to ensure synchronous bowl and blade rotation. A portion

of the assembly 10 is shown in FIG. 1 with more detail of the frictional clutch assembly 20 shown in FIG. 2. The assembly 10 comprises a spindle 60 with a lower and upper end. Bowl 85 is fixedly attached to the lower end of spindle 60 and pulley 43 is affixed to the upper end of spindle 60. A scraper blade or stilling vane shaft 61 has an upper portion fixedly attached to a sprocket 40 and a lower portion affixed to a plurality of blades 70 by a nut 71 that holds blades 70 on shaft 61. Spindle 60 and shaft 61 are concentric and spindle 60 defines an internal passage through which shaft 61 is received. The centrifuge has main bearings 50, and bearing caps 52 located within bearing housing 51. During processing, pulley 43 is driven by a belt attached to a first motor which provides motive force for turning spindle 60 and fixedly attached bowl 85 as well as shaft 61 and blades 70 through frictional clutch assembly 20. During the scraping mode motive force for the rotation of the shaft 61 and affixed blades 70 is accomplished by a chain attached around sprocket 40 that is powered by a second motor. In the scraping mode only the sprocket 40 is being driven. The sprocket 40 is free floating until actuated by pneumatic clutch 42 which forces sprocket 40 to engage frictional clutch assembly 20. Frictional clutch assembly 20 consists of an adjusting nut 21 with external threading 22. External threading 22 matches the internal threading 23 in adjusting plate 24. Adjusting plate 24 sits on four springs 25 spaced evenly around the circumference of pressure plate 27. The springs 25 are received in slots 26 defined by pressure plate 27. Pressure plate 27 rests on top of a bronze bushing 28. Bronze bushing 28 sits on friction disc 29 that sits on pulley 43. The friction disc 29

resists differences in rotational speed and is intended to ensure synchronous bowl 85 and blade 70 rotation.

Claim Rejections - 35 USC § 103

12. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

13. **Claims 2, 4, 9, and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Berger et al. (US 5,879,279) in view of Ziems et al. (US 5,454,777).**

Berger et al. '279 does not disclose the servo motor with speed adjustment means. The patent to Ziems et al. '777 discloses in FIG. 1, a centrifugal separator of with a cabinet 10 that encloses a centrifugal bowl or rotor 12 mounted on a centerline shaft 14. The shaft 14 is engaged with a drive motor 16 through pulleys 18, 20 located on the shaft 14 and drive motor 16 respectively. A belt 22 interconnects the shaft pulley 18 with the motor pulley 20. The centrifugal bowl 12 defines a shape that is cylindrical for approximately two-thirds of its length and conical for the remaining one-third of length. The conical portion 15 narrows to create an opening 17 at the bottom of the bowl 12 that is generally one-half the diameter of the cylindrical portion of the bowl 12. Cleansed fluid will be expelled through the opening 17 into the fluid outlet line 40

during the centrifuge operation and dehydrated solids are removed through the opening 17 during the cleaning of the centrifuge. The shaft 14 is fixed within a bearing cartridge affixed to the housing 10. The shaft 14 is hollow along its full length about its centerline and includes a boxed bearing housing 19 positioned above the shaft pulley 18. Provided within the centrifuge bowl 12 is a scraper 24 having at least two blades or vanes that extend radially and axially within the bowl 12 to provide a precision fit with only a slight clearance or gap with the interior wall 13 of the bowl 12. The blades 24 are fixed to a scraper shaft 26 that extends through the boxed bearing housing 19 and the hollow shaft 14 into the interior of the bowl 12. The scraper 24 and its shaft 26 are preferably driven to rotation by a gear motor 32 having an attached sprocket 34 which is engaged by means of a chain 36 with a sprocket 28 and clutch 30 which are mounted on the scraper shaft 26. While the centrifuge bowl 12 is in operation, the clutch 30 that is preferably an air clutch is disengaged, thereby allowing the scraper 24 to rotate freely with the bowl 12. If the bowl 12 has accumulated sufficient solids to necessitate a cleansing, the bowl 12 is locked in position by a rotor lock assembly and the clutch 30 and motor 32 are engaged to drive the scraper 24 about the interior wall 13 of the bowl 12 to break the dehydrated solids accumulated on the wall 13 away from the wall. Usually, the solid material then drops through the opening 17 located at the bottom of the bowl 12 into a solid material collection bin. The separator includes an effluent inlet line 38 which provides contaminated fluid to the interior of the centrifugal separator 12 and a fluid outlet line 40 which removes the cleansed fluid flowing from

the centrifugal separator. In FIG. 2, the electrical circuit for the speed and torque monitor for the separator motor 16 and the scraper drive motor 32 is shown as a block diagram. A programmable logic controller (PLC) receives input from the operator regarding the torque limit requirements for each motor. During a normal operative cycle, the PLC will send an enable signal to the AC inverter drive which in turn activates output MIA to provide power to the separator or rotor motor 16 to begin the filtration process. During the filtration process, the load sensing circuit, which is located on the inverter drive board, will continually monitor the current applied to the separator drive motor 16 and send signals to the PLC to compare with speed of rotation signals received by the PLC from a speed detection monitor located proximate the separator rotor 12. Thus, the torque or load on the drive motor 16 is measured by the PLC and compared with the limits which have been preset in the PLC by the operator. When the PLC senses that the load on the drive motor 16 is surpassing its preset limits, the MIA output is disabled to deactivate the drive motor 16. Once the separator 12 stops rotating, as detected by the speed detector, the PLC will activate the output MIB and enable the scraper motor 32. As the scraper motor 32 activates the scraper vane 24, the load sensor circuit will continually monitor the current draw or load on the scraper motor 32 and send signals to the PLC for comparison with the preset limits. If the predetermined current draw is met or surpassed, the PLC will signal the inverter drive to reverse polarity and, thereby, reverse the direction of rotation of the scraper

motor 32. As is to be further explained, the scraper motor will continue this agitation motion until it either freely rotates within the rotor 12 for a designated period of time or fails to dislodge the accumulated solids after a designated period of time, at which time the apparatus is either directed to repeat the operation sequence or shut down. The drive motor 16 for the centrifuge rotor is a variable speed motor capable of operating the centrifuge in a range of 2,000 rpm to 3,000 rpm. The variability of speed is necessitated for efficient cleansing as a result of variations in treatable particle size, particle specific gravity, degree of dehydration of collected solids and the solid/ liquid ratio. The variable speed for the drive motor 16 assists in sensing the torque/current load of the rotor bowl 12 which is used to initiate the cleaning or scraping cycle. The variable speed motor 16 will accelerate the centrifuge rotor 12 to its running speed over a timed interval, thus allowing for a smaller horsepower drive motor to be utilized. To insure that all liquid is drained from the rotor 12, the variable speed drive motor 12 will ramp down or decelerate the centrifuge bowl over a timed interval in order to properly drain liquid remaining in the rotor 12 to the clean tank as it exits the opening 17 of the bowl through the outlet line 40. If the rotor 12 is stopped too quickly, it has been experienced that the liquid will drain to the solid material disposal container.

During operation of the centrifuge of the present invention, the load on the drive motor 16 is sensed by the load sensor circuit to indicate the build-up of solids within the rotor bowl 12. The PLC is programmed to sample

the load on the rotor bowl 12 at timed intervals. As the intervals time out, the drive motor 16 is decelerated to a lower rpm by the PLC and inverter drive, for example, from 60 Hz to 50 Hz. The drive motor 16 is stabilized for a short time period at the slower running speed and then accelerated back to its normal running speed. During the acceleration, which takes approximately five seconds, the torque and current required for the acceleration are monitored and displayed by the PLC. The values are preferably shown in percentage of capacity of the motor drive (i.e. 80%). As solids build up in the bowl 12, the percentages will raise slightly due to the force required to accelerate the heavier mass. The programmable controller is preset by the operator with an upper limit on the torque or current required to accelerate the drive motor 16, rotor 12 and particle mass which is established as the point at which a cleaning cycle is initiated (i.e. 85% of the capacity of the motor drive). Since the percentage values of the torque/current limits are entered into the programmable controller, the controller will monitor the inputs received from the load sensor and when the percentage values are met or exceeded, the cleaning cycle is initiated. The programmable controller can also be programmed to override the load sensor, should the centrifuge 12 run for an extended period of time with an insufficient solid buildup to create a cleaning cycle initiated by the load sensor. The controller is programmed with a preset time interval which will initiate the cleaning cycle to prevent potential difficulty in scraping the solids which may have been excessively dehydrated

and tend to adhere firmly to the rotor 12 and wall 13. Thus, the provision of a load sensor and the programmable controller creates the desired variability in the cleaning cycle initiation; either by sensing the load and mass of material accumulated on the wall 13 of the centrifuge 12 or by timed intervals which prevent accumulation of extremely dehydrated solid which may cause difficult scraping and cleaning operations. The load limits for the scraper motor 32 can be set in much the same manner as has been described for the rotor motor 16. The torque and current usage is continually received by the controller through the load sensor during the scraping cycle. The scraping cycle is initiated by the controller in the following manner. The bowl will be decelerated and stopped and held firmly in place by a cylinder operated rotor lock assembly (not shown). When the lock has been engaged, the scraper motor 32 and air clutch 30 are actuated to begin the scraping operations. The scraper motor 32 and the scraper blades 24 will continually reverse their direction of movement according to direction from the programmable controller to cause an oscillating motion which aids in breaking the solids loose from the bowl until the cleaning cycle is completed. The controller is also preferably programmed to provide a timed interval, wherein if the solids have not been loosened or removed, the centrifuge will be shut down to prevent possible damage to the components of the centrifuge and scraper blades.

In view of the explicit teachings of Ziems et al. '777, it would have been prima facie obvious to one having ordinary skill in the art, at the time applicant's invention

was made, to have provided Berger et al. '279 with a servo motor drive means with speed adjustment means for the purposes of enhancing the operation of a centrifugal separator and automatically adjusting for varying amounts of solids in contaminated fluid being passed through the separator; monitoring the load on the drive motor of the separator centrifuge bowl and signaling for a cleaning cycle based upon the load information; automatically varying the intervals between the cleaning cycles depending upon the amount of specified solids in the fluid being passed through the separator and the load on the drive motor produced by the solids; providing for more efficient cleansing of fluids due to the more efficient operation of the centrifuge; providing the ability to optimize the frequency of cleaning cycles, thereby potentially allowing the centrifuge to remain in operation for longer periods of time via the load sensing device; monitoring the solid material scraper which enables the scraper to operate in a manner which reduces the amount of stress on the scraper blade, the blade spindle, the gear transmission and the drive motor to thereby reduce the potential for frequent mechanical failure due to overstressed parts and to reduce premature scraper motor burnout; providing a variable speed drive motor for the centrifuge bowl which provides the capability of altering the gravity forces within the centrifuge in response to the individual specific gravity of a variety of suspended solid materials whereby the variable speed drive provides the ability to provide the variations in the gravity force and to process a particular liquid at a lower gravity force and a higher flow of effluent for a given period of time and then increase the gravity force and reduce the effluent

flow to create greater residence time and a much higher reduction in the fine particles; wherein the load sensing device taken in combination with the variable speed drive for the centrifuge provides the ability to efficiently and variably monitor the cleansing intervals to provide predetermined levels of cleansing and prevent the overloading of the scraper and scraper mechanics; to provide an improved centrifugal separator capable of varying the solid cleansing intervals to maintain peak efficiency in the cleansing of effluent being passed through the separator; to provide a simple load sensing device for controlling and monitoring the amount of solids accumulated on the side walls of the centrifuge; to provide a load sensing device on the scraper mechanism to monitor solid material quantity and assist in preventing damage to the scraper mechanical and electrical components; and to provide a variable speed drive for the centrifuge to accommodate the differing specific gravities of solid material and the removal of material in a variety of sizes (col. 2, line 42- col. 3, line 49).

14. **Claims 2, 9, and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Beattey (US 6,478,724) in view of Ziems et al. (US 5,454,777).**

Beattey (US 6,478,724) does not disclose the servo motor with speed adjustment means. The patent to Ziems et al. '777 discloses in FIG. 1, a centrifugal separator of with a cabinet 10 that encloses a centrifugal bowl or rotor 12 mounted on a centerline shaft 14. The shaft 14 is engaged with a drive motor 16 through pulleys 18, 20 located on the shaft 14 and drive motor 16 respectively. A belt 22 interconnects the shaft

pulley 18 with the motor pulley 20. The centrifugal bowl 12 defines a shape that is cylindrical for approximately two-thirds of its length and conical for the remaining one-third of length. The conical portion 15 narrows to create an opening 17 at the bottom of the bowl 12 that is generally one-half the diameter of the cylindrical portion of the bowl 12. Cleansed fluid will be expelled through the opening 17 into the fluid outlet line 40 during the centrifuge operation and dehydrated solids are removed through the opening 17 during the cleaning of the centrifuge. The shaft 14 is fixed within a bearing cartridge affixed to the housing 10. The shaft 14 is hollow along its full length about its centerline and includes a boxed bearing housing 19 positioned above the shaft pulley 18. Provided within the centrifuge bowl 12 is a scraper 24 having at least two blades or vanes that extend radially and axially within the bowl 12 to provide a precision fit with only a slight clearance or gap with the interior wall 13 of the bowl 12. The blades 24 are fixed to a scraper shaft 26 that extends through the boxed bearing housing 19 and the hollow shaft 14 into the interior of the bowl 12. The scraper 24 and its shaft 26 are preferably driven to rotation by a gear motor 32 having an attached sprocket 34 which is engaged by means of a chain 36 with a sprocket 28 and clutch 30 which are mounted on the scraper shaft 26. While the centrifuge bowl 12 is in operation, the clutch 30 that is preferably an air clutch is disengaged, thereby allowing the scraper 24 to rotate freely with the bowl 12. If the bowl 12 has accumulated sufficient solids to necessitate a cleansing, the bowl 12 is locked in position by a rotor lock assembly and the clutch 30 and motor 32 are engaged to drive the scraper 24 about the interior wall 13 of the bowl 12 to break the dehydrated solids accumulated on the wall 13 away from

the wall. Usually, the solid material then drops through the opening 17 located at the bottom of the bowl 12 into a solid material collection bin. The separator includes an effluent inlet line 38 which provides contaminated fluid to the interior of the centrifugal separator 12 and a fluid outlet line 40 which removes the cleansed fluid flowing from the centrifugal separator. In FIG. 2, the electrical circuit for the speed and torque monitor for the separator motor 16 and the scraper drive motor 32 is shown as a block diagram. A programmable logic controller (PLC) receives input from the operator regarding the torque limit requirements for each motor. During a normal operative cycle, the PLC will send an enable signal to the AC inverter drive which in turn activates output MIA to provide power to the separator or rotor motor 16 to begin the filtration process. During the filtration process, the load sensing circuit, which is located on the inverter drive board, will continually monitor the current applied to the separator drive motor 16 and send signals to the PLC to compare with speed of rotation signals received by the PLC from a speed detection monitor located proximate the separator rotor 12. Thus, the torque or load on the drive motor 16 is measured by the PLC and compared with the limits which have been preset in the PLC by the operator. When the PLC senses that the load on the drive motor 16 is surpassing its preset limits, the MIA output is disabled to deactivate the drive motor 16. Once the separator 12 stops rotating, as detected by the speed detector, the PLC will activate the output MIB and enable the scraper motor 32. As the scraper motor 32 activates the scraper vane 24, the load sensor circuit will

continually monitor the current draw or load on the scraper motor 32 and send signals to the PLC for comparison with the preset limits. If the predetermined current draw is met or surpassed, the PLC will signal the inverter drive to reverse polarity and, thereby, reverse the direction of rotation of the scraper motor 32. As is to be further explained, the scraper motor will continue this agitation motion until it either freely rotates within the rotor 12 for a designated period of time or fails to dislodge the accumulated solids after a designated period of time, at which time the apparatus is either directed to repeat the operation sequence or shut down. The drive motor 16 for the centrifuge rotor is a variable speed motor capable of operating the centrifuge in a range of 2,000 rpm to 3,000 rpm. The variability of speed is necessitated for efficient cleansing as a result of variations in treatable particle size, particle specific gravity, degree of dehydration of collected solids and the solid/ liquid ratio. The variable speed for the drive motor 16 assists in sensing the torque/current load of the rotor bowl 12 which is used to initiate the cleaning or scraping cycle. The variable speed motor 16 will accelerate the centrifuge rotor 12 to its running speed over a timed interval, thus allowing for a smaller horsepower drive motor to be utilized. To insure that all liquid is drained from the rotor 12, the variable speed drive motor 12 will ramp down or decelerate the centrifuge bowl over a timed interval in order to properly drain liquid remaining in the rotor 12 to the clean tank as it exits the opening 17 of the bowl through the outlet line 40. If the rotor 12 is stopped too quickly, it has been experienced that the liquid will drain to the solid material disposal

container.

During operation of the centrifuge of the present invention, the load on the drive motor 16 is sensed by the load sensor circuit to indicate the build-up of solids within the rotor bowl 12. The PLC is programmed to sample the load on the rotor bowl 12 at timed intervals. As the intervals time out, the drive motor 16 is decelerated to a lower rpm by the PLC and inverter drive, for example, from 60 Hz to 50 Hz. The drive motor 16 is stabilized for a short time period at the slower running speed and then accelerated back to its normal running speed. During the acceleration, which takes approximately five seconds, the torque and current required for the acceleration are monitored and displayed by the PLC. The values are preferably shown in percentage of capacity of the motor drive (i.e. 80%). As solids build up in the bowl 12, the percentages will raise slightly due to the force required to accelerate the heavier mass. The programmable controller is preset by the operator with an upper limit on the torque or current required to accelerate the drive motor 16, rotor 12 and particle mass which is established as the point at which a cleaning cycle is initiated (i.e. 85% of the capacity of the motor drive). Since the percentage values of the torque/current limits are entered into the programmable controller, the controller will monitor the inputs received from the load sensor and when the percentage values are met or exceeded, the cleaning cycle is initiated. The programmable controller can also be programmed to override the load sensor, should the centrifuge 12 run for an

extended period of time with an insufficient solid buildup to create a cleaning cycle initiated by the load sensor. The controller is programmed with a preset time interval which will initiate the cleaning cycle to prevent potential difficulty in scraping the solids which may have been excessively dehydrated and tend to adhere firmly to the rotor 12 and wall 13. Thus, the provision of a load sensor and the programmable controller creates the desired variability in the cleaning cycle initiation; either by sensing the load and mass of material accumulated on the wall 13 of the centrifuge 12 or by timed intervals which prevent accumulation of extremely dehydrated solid which may cause difficult scraping and cleaning operations. The load limits for the scraper motor 32 can be set in much the same manner as has been described for the rotor motor 16. The torque and current usage is continually received by the controller through the load sensor during the scraping cycle. The scraping cycle is initiated by the controller in the following manner. The bowl will be decelerated and stopped and held firmly in place by a cylinder operated rotor lock assembly (not shown). When the lock has been engaged, the scraper motor 32 and air clutch 30 are actuated to begin the scraping operations. The scraper motor 32 and the scraper blades 24 will continually reverse their direction of movement according to direction from the programmable controller to cause an oscillating motion which aids in breaking the solids loose from the bowl until the cleaning cycle is completed. The controller is also preferably programmed to provide a timed interval, wherein if the solids have not been loosened or removed, the centrifuge will be shut

down to prevent possible damage to the components of the centrifuge and scraper blades.

In view of the explicit teachings of Ziems et al. '777, it would have been prima facie obvious to one having ordinary skill in the art, at the time applicant's invention was made, to have provided Beattey '724 with a servo motor drive means with speed adjustment means for the purposes of enhancing the operation of a centrifugal separator and automatically adjusting for varying amounts of solids in contaminated fluid being passed through the separator; monitoring the load on the drive motor of the separator centrifuge bowl and signaling for a cleaning cycle based upon the load information; automatically varying the intervals between the cleaning cycles depending upon the amount of specified solids in the fluid being passed through the separator and the load on the drive motor produced by the solids; providing for more efficient cleansing of fluids due to the more efficient operation of the centrifuge; providing the ability to optimize the frequency of cleaning cycles, thereby potentially allowing the centrifuge to remain in operation for longer periods of time via the load sensing device; monitoring the solid material scraper which enables the scraper to operate in a manner which reduces the amount of stress on the scraper blade, the blade spindle, the gear transmission and the drive motor to thereby reduce the potential for frequent mechanical failure due to overstressed parts and to reduce premature scraper motor burnout; providing a variable speed drive motor for the centrifuge bowl which provides the capability of altering the gravity forces within the centrifuge in response to the individual specific gravity of a variety of suspended solid materials whereby the

variable speed drive provides the ability to provide the variations in the gravity force and to process a particular liquid at a lower gravity force and a higher flow of effluent for a given period of time and then increase the gravity force and reduce the effluent flow to create greater residence time and a much higher reduction in the fine particles; wherein the load sensing device taken in combination with the variable speed drive for the centrifuge provides the ability to efficiently and variably monitor the cleansing intervals to provide predetermined levels of cleansing and prevent the overloading of the scraper and scraper mechanics; to provide an improved centrifugal separator capable of varying the solid cleansing intervals to maintain peak efficiency in the cleansing of effluent being passed through the separator; to provide a simple load sensing device for controlling and monitoring the amount of solids accumulated on the side walls of the centrifuge; to provide a load sensing device on the scraper mechanism to monitor solid material quantity and assist in preventing damage to the scraper mechanical and electrical components; and to provide a variable speed drive for the centrifuge to accommodate the differing specific gravities of solid material and the removal of material in a variety of sizes (col. 2, line 42- col. 3, line 49).

Conclusion

15. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

The cited prior art discloses centrifuges with clutches and/or scraping devices in the bowls.

16. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Charles E. Cooley whose telephone number is (571) 272-1139. The examiner can normally be reached on Mon-Fri. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

17. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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2 April 2005